Training Course for CWR Internals

Networking

Routing Setup

Bridging & Routing Basics

Collision Domains and Broadcast Domains

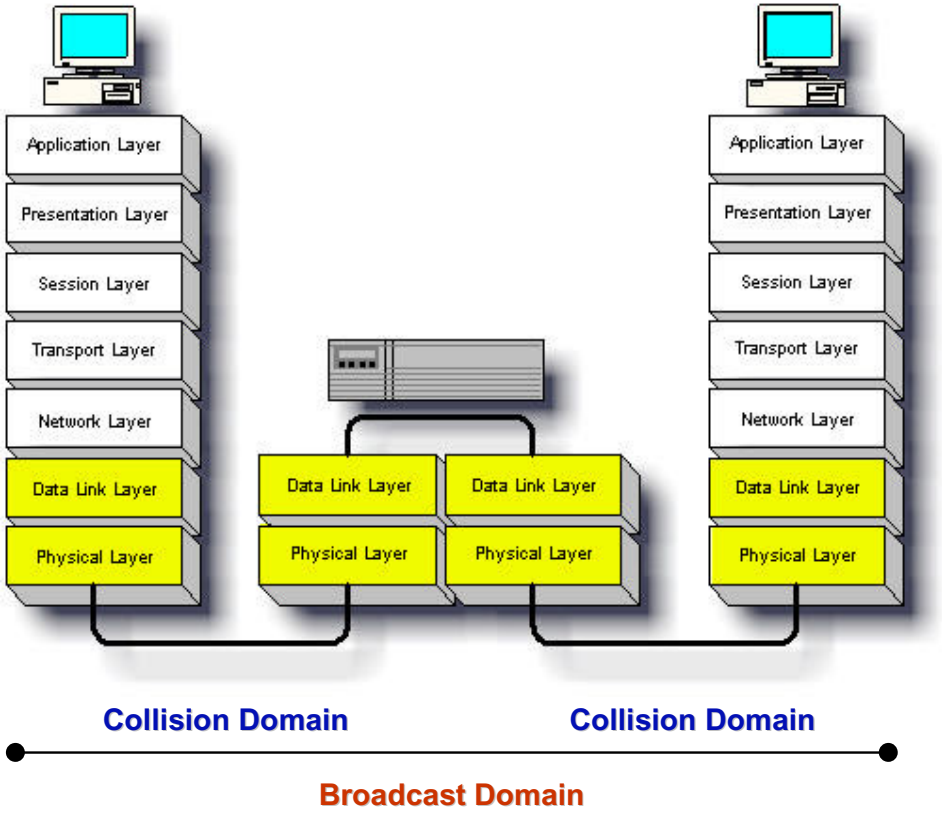
- A **Collision Domain** is a common physical network area where stations compete for media access and bandwidth using the (Ethernet) CSMA/CD media access method
- A **Broadcast Domain** is a common network area where messages addressed to all stations (broadcast) or a subset of stations (multicast) are distributed to any connected host

What is a Network Bridge ?

- A bridge **joins physical LANs** on the Data Link OSI Layer and forwards data packets between these physical subnetworks
- The **forwading** decisions are only **based on MAC (Media Access Control) destination addresses**
- All data packets are transmitted **protocol-transparently** between physical subnets. This means a bridge is not aware and does not filter upper layer protocol stacks like TCP/IP or AppleTalk
- Bridges combine physical LANs to build a broadcast domain and **divide** them **into collision domains**
- When bridges are used, the technology of the networks to be linked does not necessarily need to be identical (translating bridges)
- Bridges typically **only forward error-free data packets** and filter faulty packets

Bridging & Routing Basics

The **Bridge** between network islands



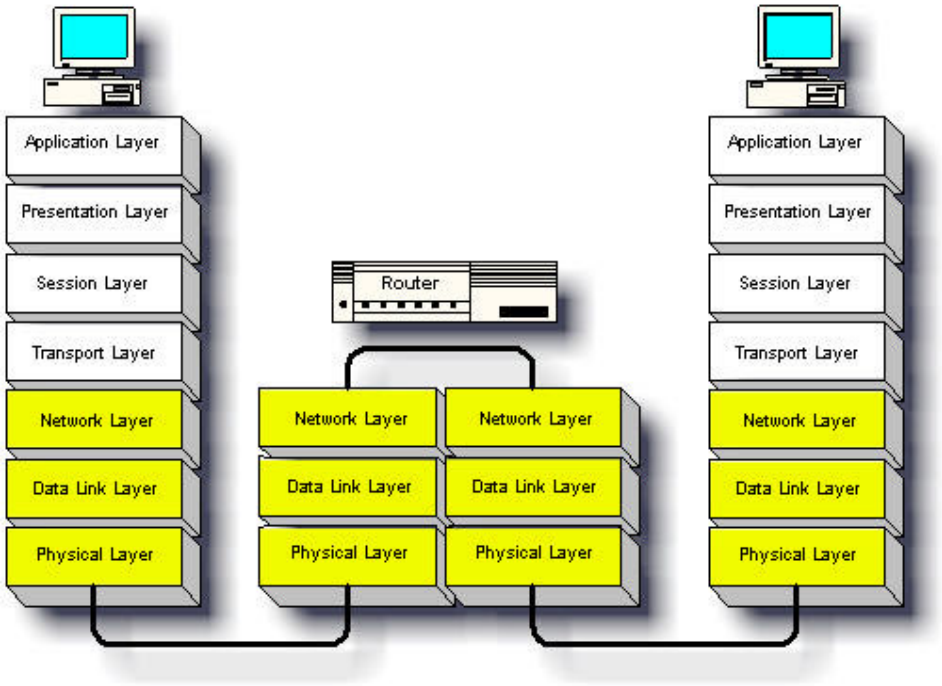
Bridging & Routing Basics

What is a Network Router ?

- A Router **links physical or virtual subnetworks** on the OSI Network Layer
- **Subnetworks can then be logically addressed in an „internetwork“** (a net of sub-networks)
- Routers forward only data packets between networks which are at least provided with **identical Network Layer implementations such as IP or IPX**
- Routers may support several network protocol types in parallel
- The **forwarding** decisions are **based on logical network addresses** such as Internet Addresses or AppleTalk Network Numbers
- Routers **devide networks into broadcast domains**. This means (subnet-local) broadcast messages are filtered at router boundaries
- Routers are used for:
  - **logical network segmentation** such as departemental networks within a company‘s network environment
  - **broadcast containment** to avoid broadcast storms
  - **security reasons**

Bridging & Routing Basics

The **Router** between sub-network



Bridging & Routing Basics

Dedicate versus Non-dedicated Routers

- **Dedicated Routers are active network devices specially designed and optimized for inter-subnet packet forwarding**
- **Non-dedicated Routers are regular computers such as Windows NT or UNIX servers** which are equipped with at least two network interface cards and configured to route (IP, IPX and/or AppleTalk) data packets between subnetworks
- The computing of forwarding decisions consumes CPU time and memory resources
- For a network environment with **frequent inter-subnet traffic** dedicated routers should be used to reduce the forwarding latency and to off-load computers such as servers from the burden of routing acivities
- For a network environment with **infrequent routing traffic** computers such as Windiws NT servers may be configured and used as (non-dedicated) routers

Routing Setup

General Information

- Routing allows Hosts located in **different Networks** to communicate with each other
- In a multi-segmented Network, **Routers act as Links** between the network segments
- Routing Mechanisms are **different** for the various Network Protocols, i.E. **AppleTalk- vs. IP-Routing**
- **Protocol-specific Routing Mechanisms** have to be installed on each Server acting as a Link between different Networks or Segments
- Routing Servers require as many **Network-Interfaces** as the number of Networks they shall route between

Routing Setup

IP -Routing

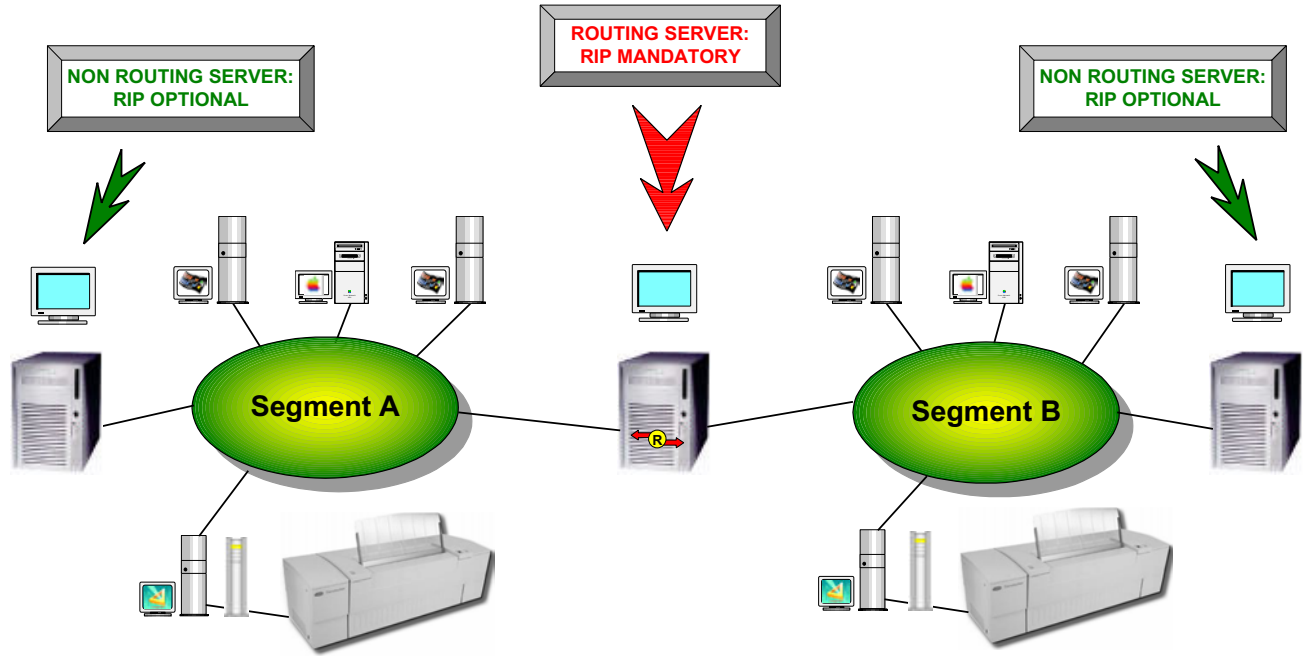
- Hosts with an **OSI Network Layer** Implementation conforming to the **I**nternet **P**rotocol are referred to as **IP-Hosts**
- IP-Hosts located in different (Sub-) Networks communicate via **IP-Routers**
- Routers employ **Routing Tables** for packet forwarding between (Sub-) Networks
- Routing Tables can be either **static or dynamic**
- **Static** Routing Tables have to be edited **manually**
- **Dynamic** Routing Tables are updated **automatically**
- A special **Protocol** has to be setup for **dynamic administration** of Routing Tables
- The most commonly employed **Routing Protocol for IP** Networks is **RIP** (**R**outing **I**nformation **P**rotocol)

Routing Setup

IP-Routing

- Each **IP-Host** has a (worldwide) **unique IP-Address**
- IP-Addresses are **logical** addresses not physical, they are independent of the physical (MAC-) Address
- IP Addresses are **4 Byte**, normally represented by 4 decimals separated by dots, i.e. 193.103.2.79
- The **I**nternet **P**rotocol defines **three basic types of IP-Addresses** for different Network complexities
- **Type A:** One Byte for addressing the Network, three Bytes for addressing Hosts on the Network. Type A Addresses **range from 1 - 127** in the first Byte
- **Type B:** Two Bytes for addressing the Network, two Bytes for addressing Hosts on the Network. Type B Addresses **range from 128 - 191**
- **Type C:** Three Bytes for addressing the Network, one Byte for addressing Hosts on the Network. Type C Addresses **range from 192 - 223**

Routing Setup



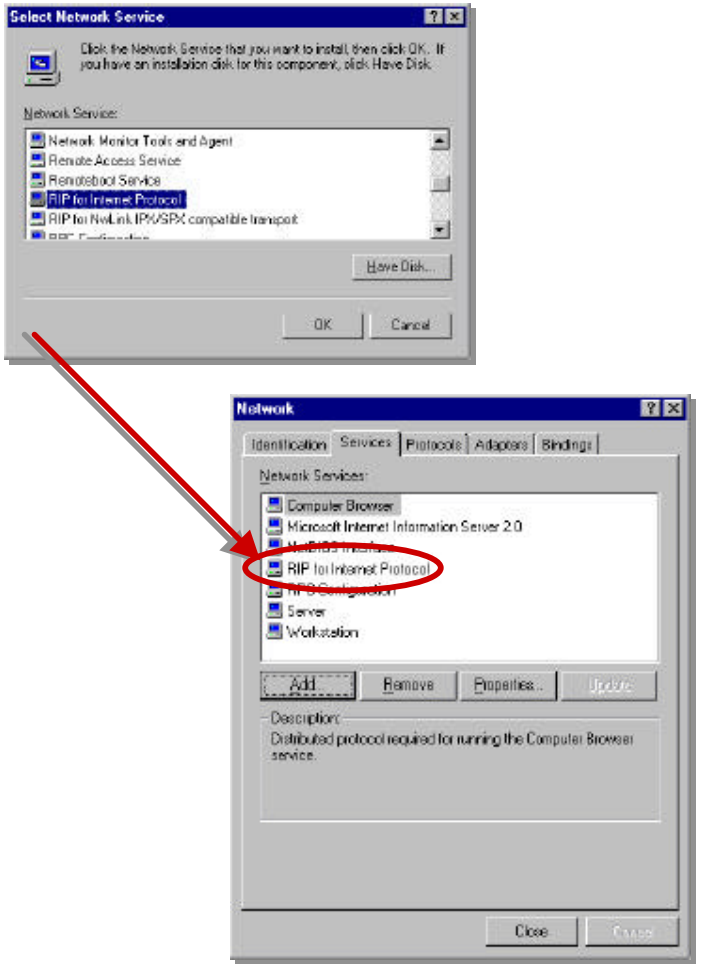
RIP Installation

- **RIP: Routing Information Protocol for IP Networks**
- **RIP** provides for dynamic Exchange / Update of Routing Tables
- **Installation** of RIP Services is **suggested** if Server is connected to a multi-segmented Network
- **Installation** of RIP Services is **mandatory** if the Server itself acts as an **IP-Router**
- RIP is available for **Windows NT Servers only**, not for Workstations

Routing Setup

RIP for NT Server: Installation

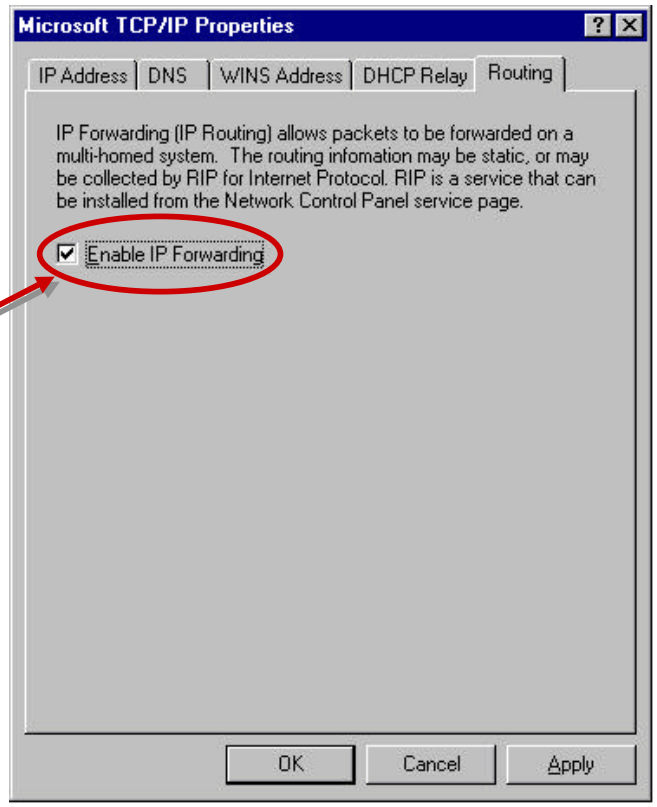
- RIP Installation requires NT-CDROM
- Login as **Administrator**
- Open Control Panel
- Select Network / Services / **Add RIP** for Internet Protocol
- **Restart** Server
- Specification of a Default Gateway is not required
- **Re-Install Service Pack 3**



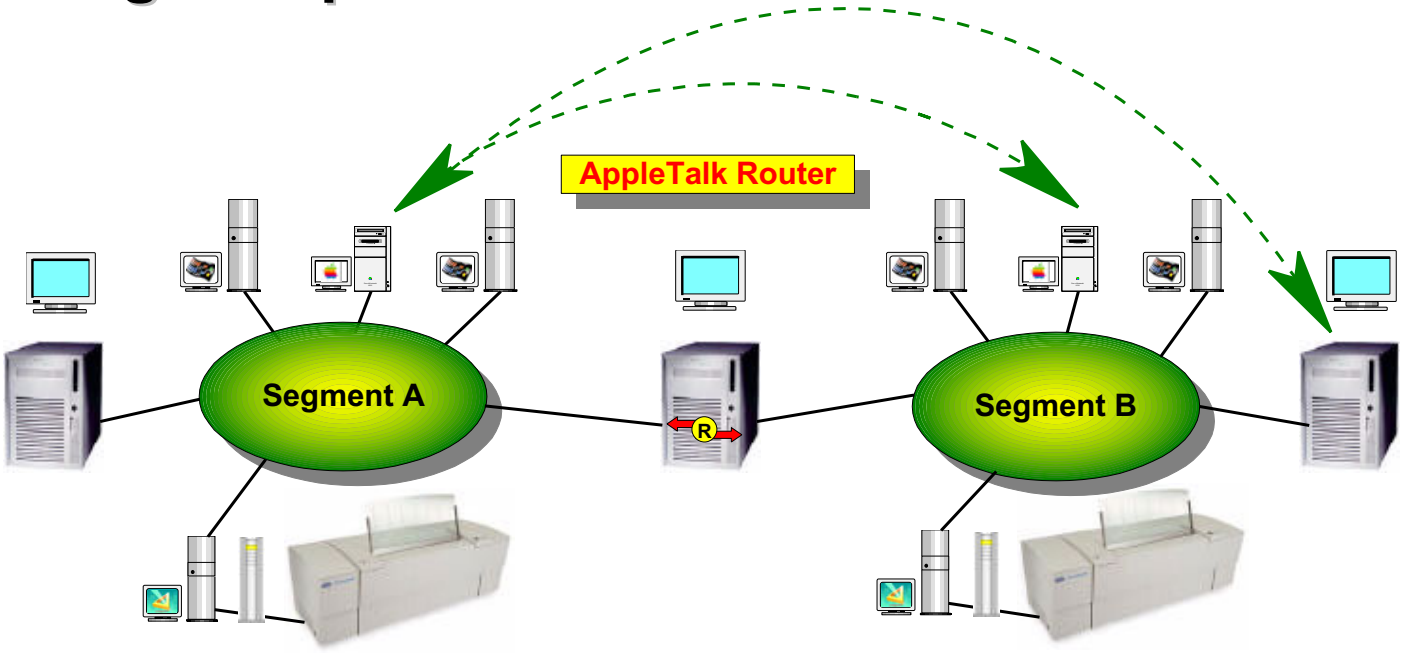
Routing Setup

Setup IP Routing on NT Server

- Log in as **Administrator**
- **TCP/IP** is already installed
- **RIP Service** is already installed
- Open **Control Panel**
- Select Network / Services / Protocols / TCP/IP Protocol / Properties / **Routing**
- Check Box: **Enable IP Forwarding**
- **Restart Server**
- Server will now forward **IP Packets** between connected Subnetworks



Routing Setup

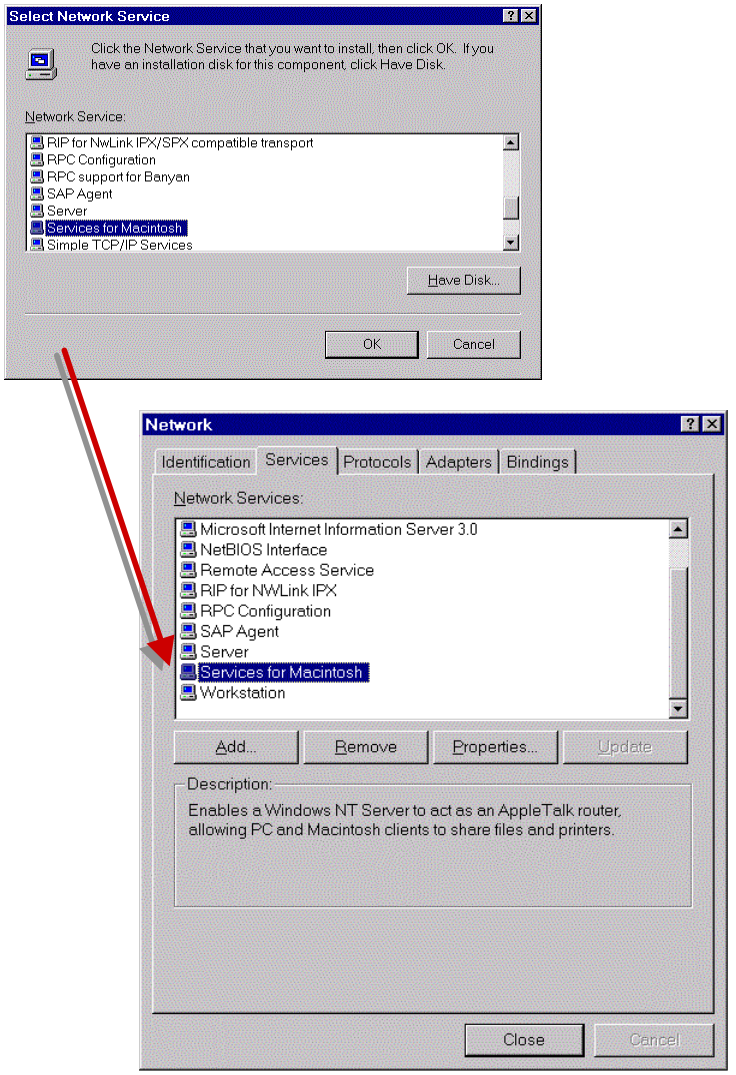


- **AppleTalk Routing** has to be enabled on the Routing Server when Apple Macintosh Clients shall access other Mac‘s or NT Servers located in **different Network Segments**
- AppleTalk Routing requires installation of **Services for Macintosh** on the Routing Server
- Services for Mac provide **File Sharing, Printer Sharing and AppleTalk Routing**

Routing Setup

Services for Macintosh: Installation on NT-Server

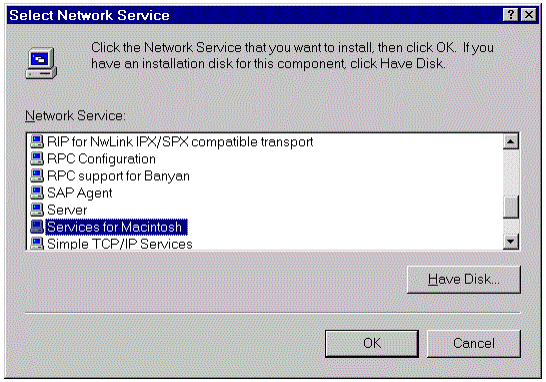
- Installation requires NT-CDROM
- Login as **Administrator**
- Open Control Panel
- Select Network / Services / **Add Services for Macintosh**
- **Restart** Server
- **Re-Install Service Pack 3**

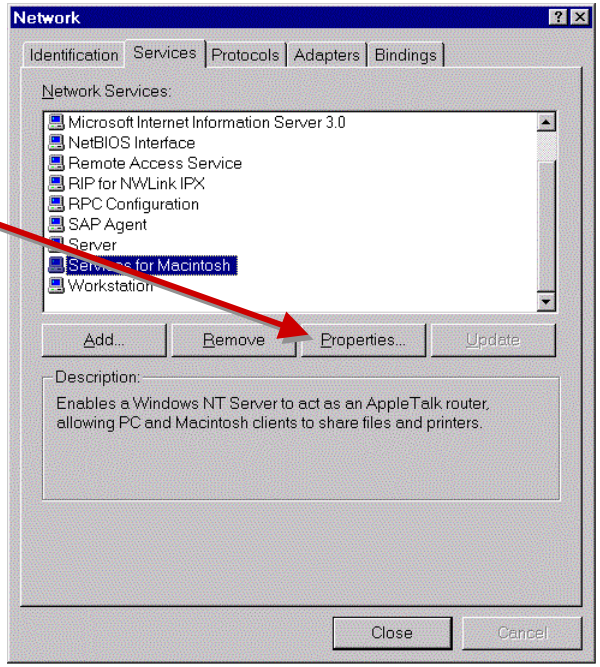


Routing Setup

Services for Macintosh: Configuration

- Login as **Administrator**
- Open Control Panel
- Select Network / Services / **Services for Macintosh / Properties**
- From the **General Tab** select Default Network Adapter and Default Zone. Mac Clients located in the same network and Zone can use File and Print Services offered by this Server



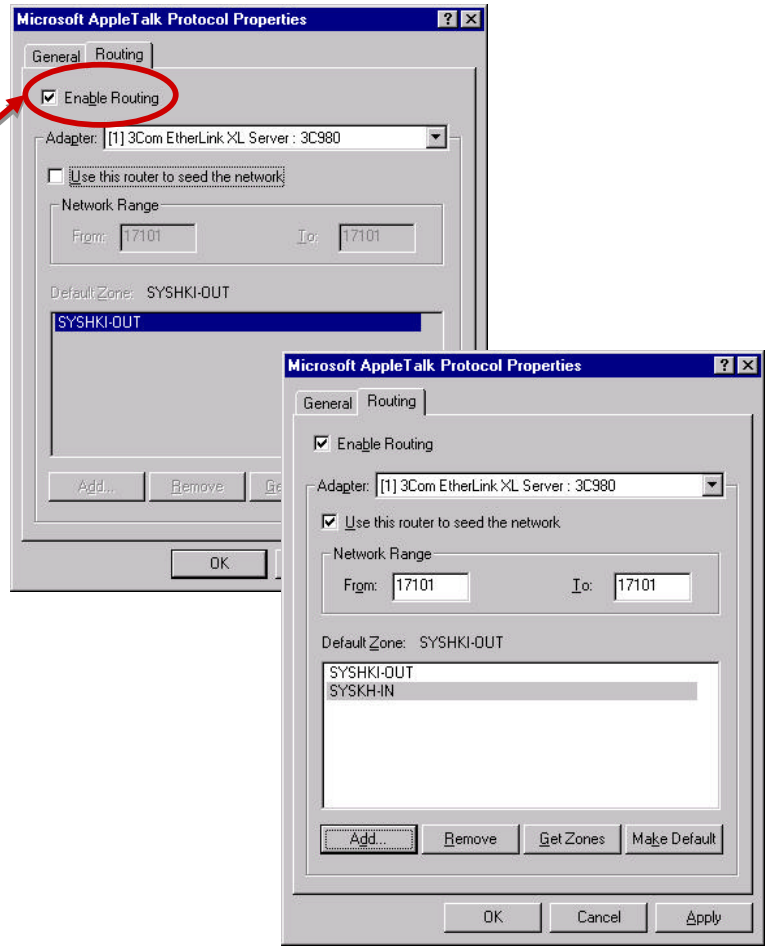


Routing Setup

Services for Macintosh:

Configuration (1)

- From the **Routing Tab** you enable **AppleTalk Routing** by checking the appropriate Box. You may choose this Server to act as a seeding or non seeding Router depending on your overall Network Configuration.
- Note: **Seeding Routers** will propagate their Routing Information to all reachable Networks, careful selection is required!
- Configure only **one server per Network** as Seeding Router

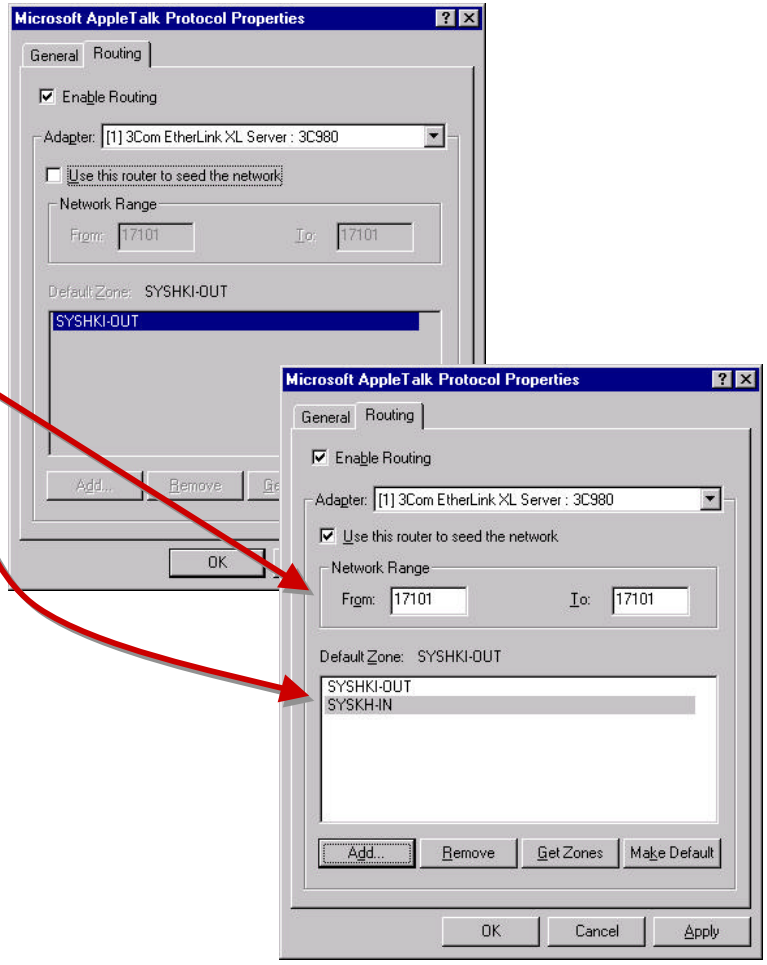


Routing Setup

Services for Macintosh:

Configuration (2)

- If you configure your Server as a Seeding Router, specify the corresponding **Network Range** and **Default Zone**
- **Restart** the AppleTalk Protocol from the Control Panel:
- Devices / AppleTalk Protocol / **Stop ... Start**
- Use the **Filemanager** to manage Volumes on your Server to be shared by Mac Clients



End of the Training Course on Network Routing Setup